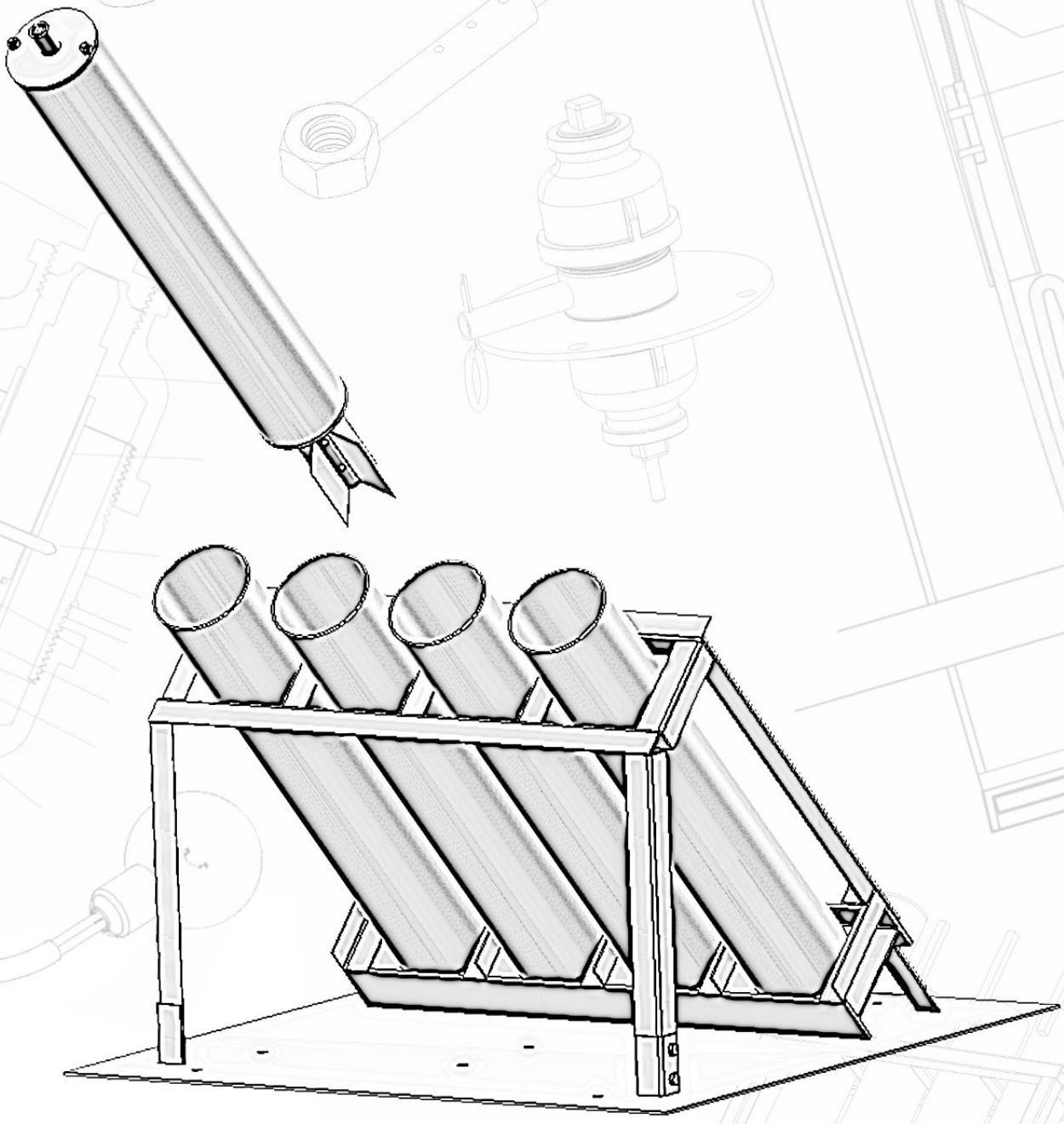
THE PIRA MK 10 IMPROVISED MORTAR SYSTEM



STANDARD IMPROVISED MUNITIONS

Standard Improvised Munitions Vol.1

The PIRA MK 10 Improvised Mortar System

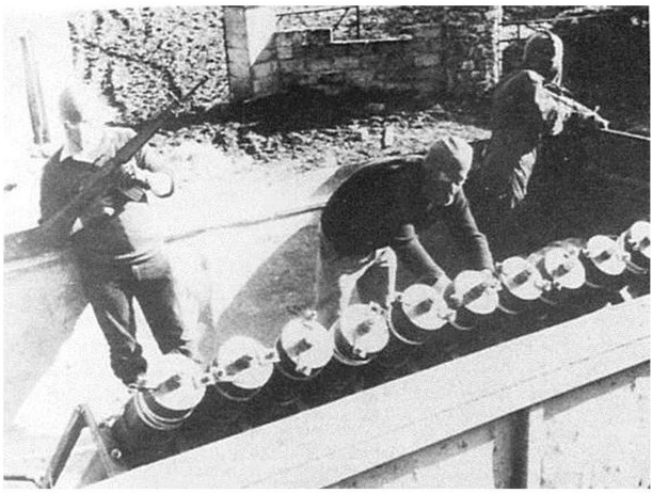
Intended for Academic Study Purposes Only

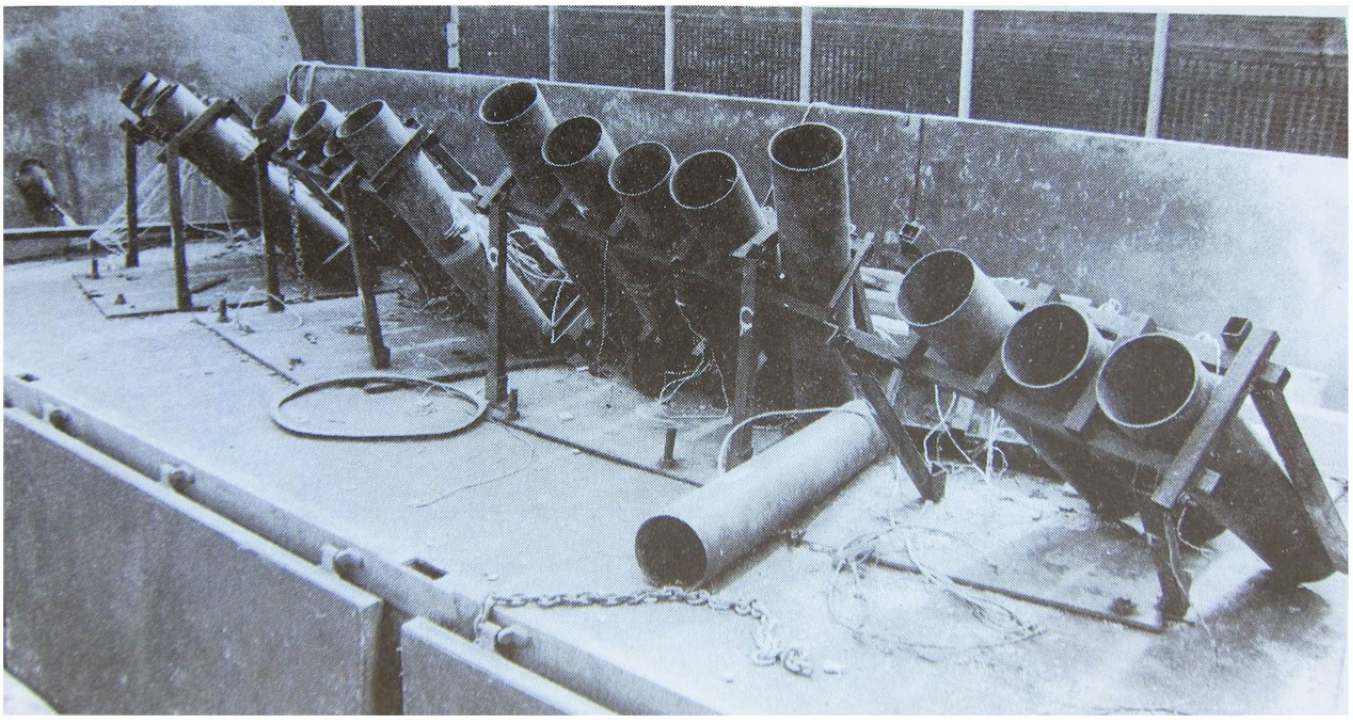
PIRA Mark 10 Improvised Mortar Bomb

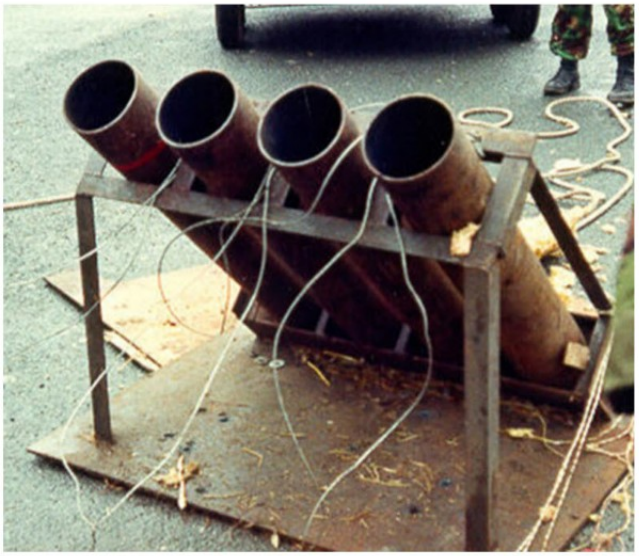
The PIRA MK 10 mortar system was first introduced in March 1979 and encompasses bombs with both electrically as well as later developed mechanical and impact initiated fuzing mechanisms. Each of the bombs contain approximately 20.5kg of improvised explosive (Either loose or in bags). This is usually ammonium nitrate / nitrobenzene (ANNIE) although SEMTEX-H has occasionally been used. Attacks have ranged from the use of a single, man-portable tube, to banks of up to 18, the base-plate bolted to a launch platform - usually a flat-bed lorry or van with a section of the roof removed and camouflaged using spray painted cardboard. The base-plate consists of a H section steel girder into which are set the launch tubes supported by a launch frame fabricated from steel box tubing or angle iron. The launch tubes are invariably made from 7" diameter industrial gas cylinders from which the valve assemblies are removed. The bombs themselves are constructed from 6.5" overall diameter rolled steel pipe of an approximate 1 meter length and again, these are usually cut-down gas cylinders - often oxy-acetylene welding or Guinness gas bottles sourced from pubs. Three MK-10 mortars were used to attack 10 Downing Street in London while British Prime Minister John Major's War Cabinet were meeting on February 7th 1991.

The initiation system of the MK 10/1 is ingeniously simple and consists of a flash bulb and a length of safety fuse crimped to a plain detonator. Taped to the detonator is a length of Cordtex which runs down the center of the bomb inside a piece of plastic conduit (a charge of commercial explosive is sometimes substituted in place of Cordtex). Upon launch the flash bulb is simultaneously ignited which in turn ignites the safety fuse which burns for a number of seconds before detonation, allowing time for the bomb to land on its target. The propellant unit is in the form of a steel pipe or spigot with several vent holes drilled into it which is screwed to the base of the bomb via a coupling. Early models contained a sodium chlorate and sugar mix but this soon changed to a fine improvised black powder, the quantity and quality determining range. The remaining space in the spigot tube is packed with a tissue paper wadding. The propellant powder is ignited by a flash bulb - the wires protrude through a hole in the bottom of the spigot and are connected from there to the firing pack.

The firing angle is set at approximately 45 degrees and range has varied from 50 to 350 meters. The launch tubes are often set at varying angles to maximize target coverage and timed to fire at two second intervals, alternating far left to far right to maintain balance of the vehicle. The MK10/1 bombs are not point detonating and rely on the delay of the burning safety fuse and they sometimes air burst, fail to launch and explode in the tube or fail completely due to the overall simplicity of the system. If they land on target however they can cause devastating damage. The weapon is ambitious but lethal with very good shrapnel effect. Initiation in the past has included command wire, radio control and timers. When fired from a truck or van the wires are fed through a hole into the cab to a Timing & Power Unit placed on the passenger seat. The driver positions the vehicle using a permanent known feature in the landscape (such as a radio mast in the case of an Army base), often using a strip of black tape on the windscreen to align. He then only need flip two switches and remove two pegs from the TPU to arm the system and escape.







MK 10 mortar pre-attack preparation, fired launch tubes and components.

PIRA Mark-10 Improvised Mortar Bomb

Overall length	1.4m
Bomb length	1m
Bomb diameter	165mm (6.5")
Bomb body	Oxy-acetylene gas cylinder
Ignition	Electric
Fuze initiation	Flash bulb and safety fuse
Main filling	20.5KG ammonium nitrate / nitrobenzene
Total filled weight	60KG

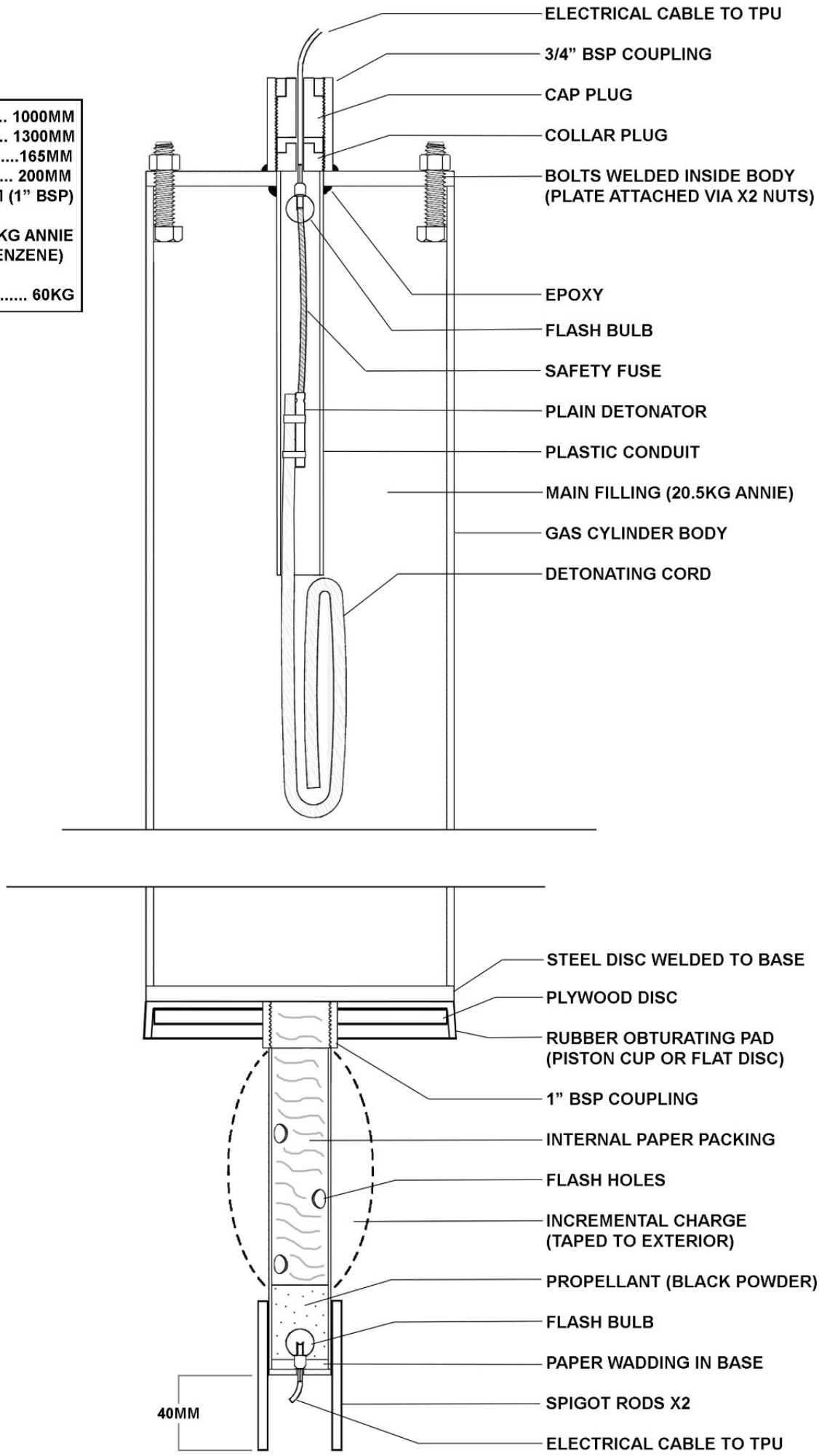
PIRA MK10 IMPROVISED MORTAR BOMB

(MK10/1 FUZE)

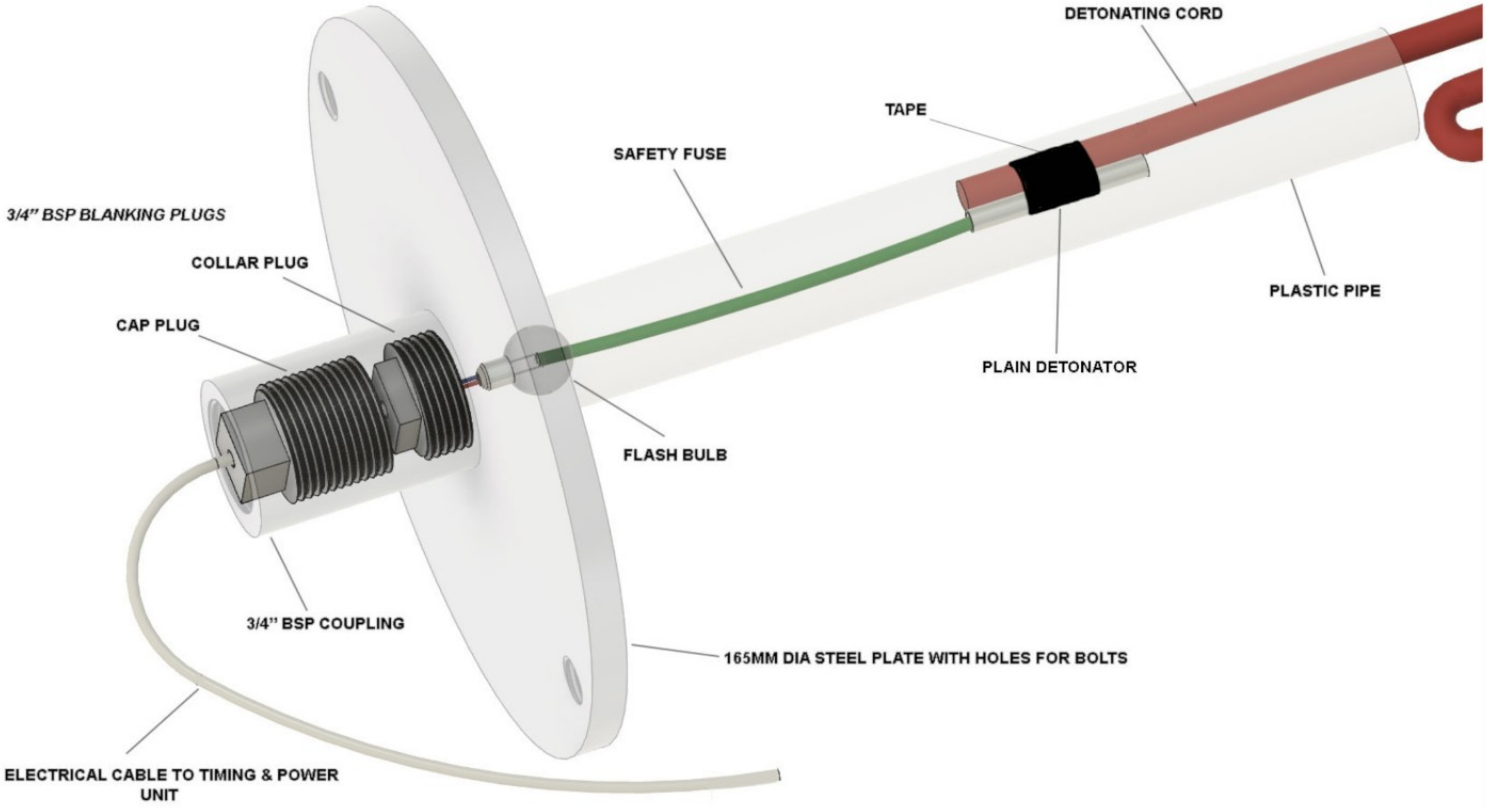
BOMB BODY LENGTH: 1000MM
OVERALL LENGTH: 1300MM
BOMB BODY DIA: 165MM
SPIGOT TUBE LENGTH: 200MM
SPIGOT TUBE DIA ..... 33MM (1" BSP)

FILLER: .....20.5KG ANNIE
(AMMONIUM NITRATE / NITROBENZENE)

OVERALL WEIGHT: 60KG

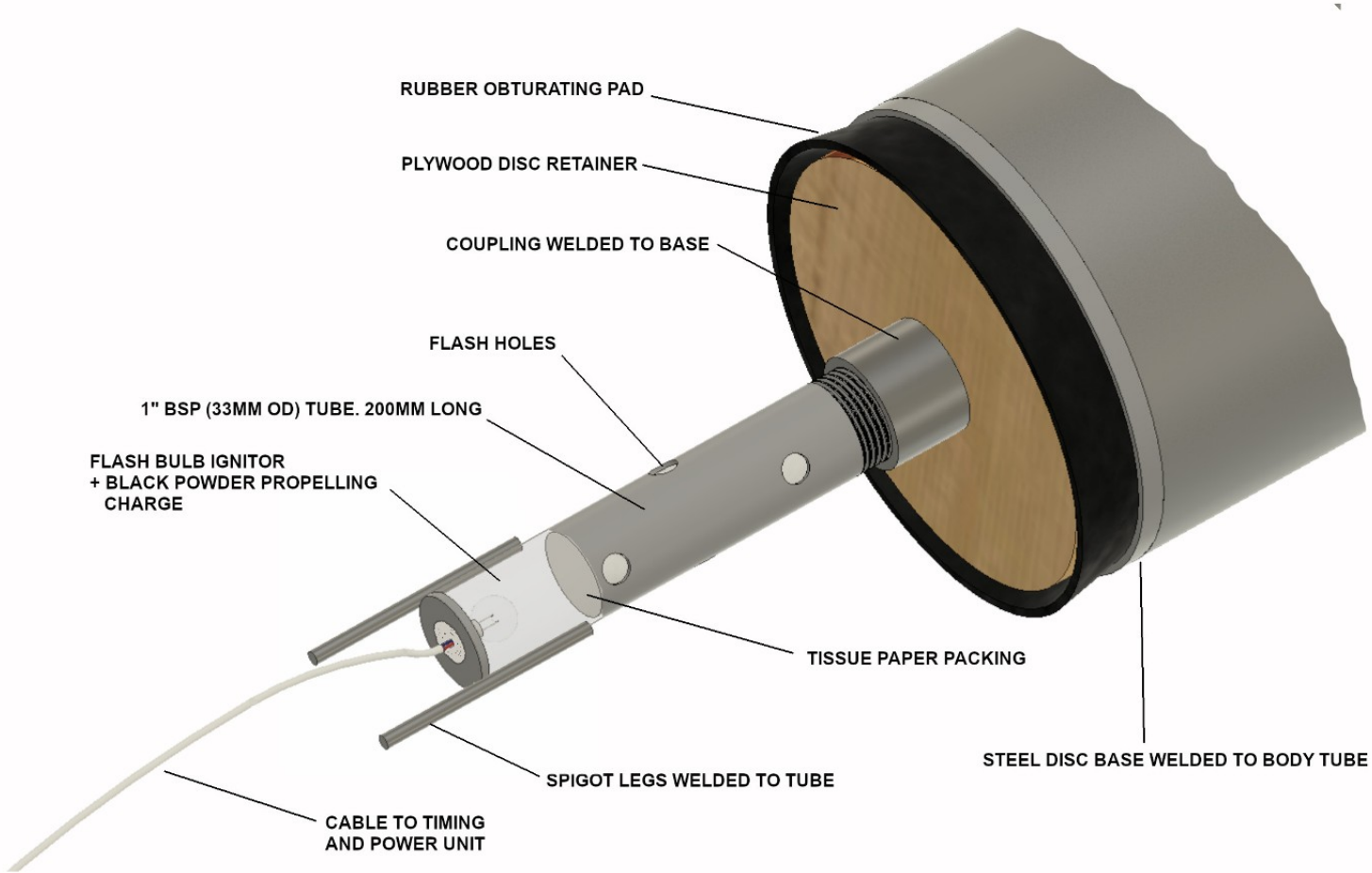


PIRA MK10/1 MORTAR FUZE

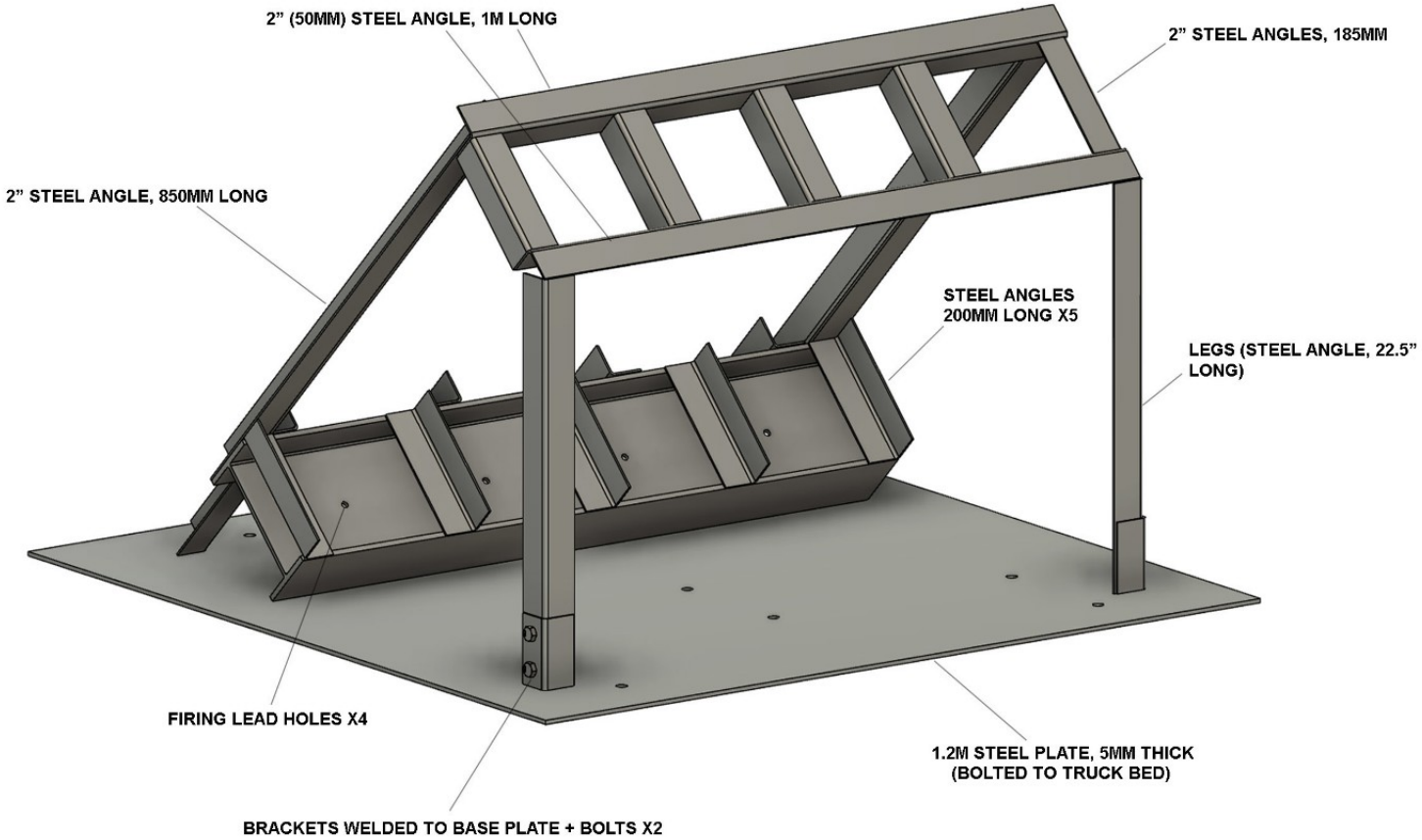


PROPELLING UNIT

SCREWED INTO BASE



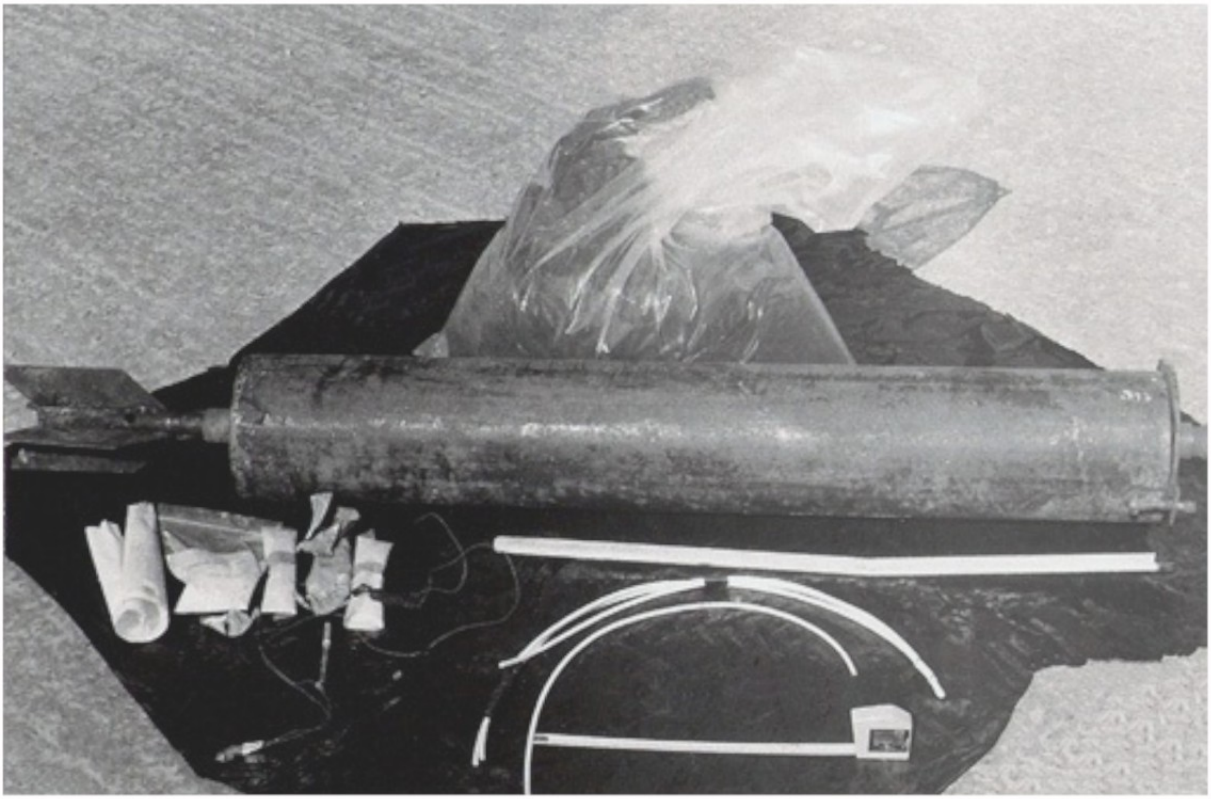
MK 10 MORTAR LAUNCH FRAME



LAUNCH TUBES

OXY-ACETYLENE CYLINDERS WITH TOPS REMOVED AND HOLE DRILLED IN BASE FOR ELECTRICAL CABLE

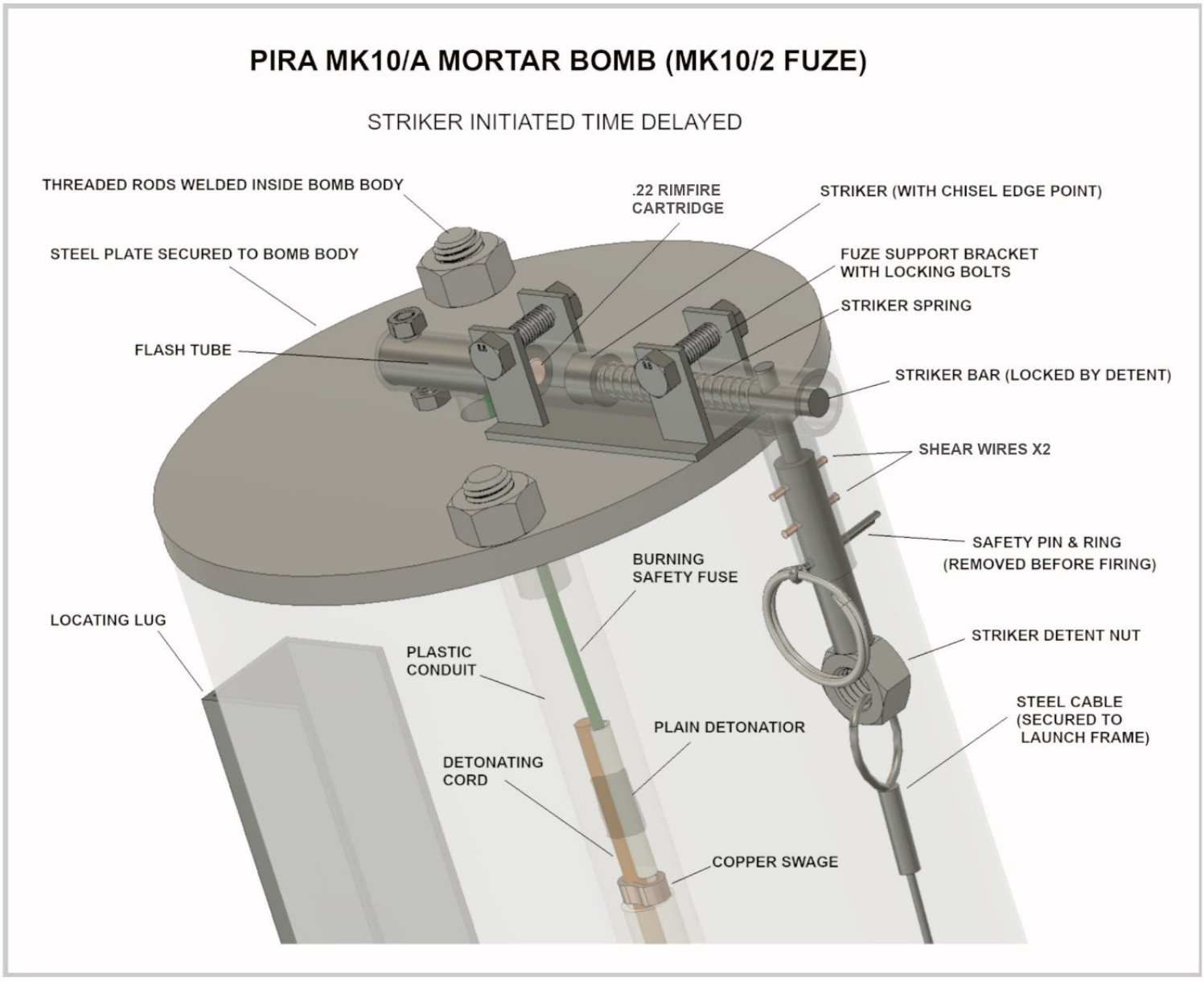
7" DIA, 1M LONG



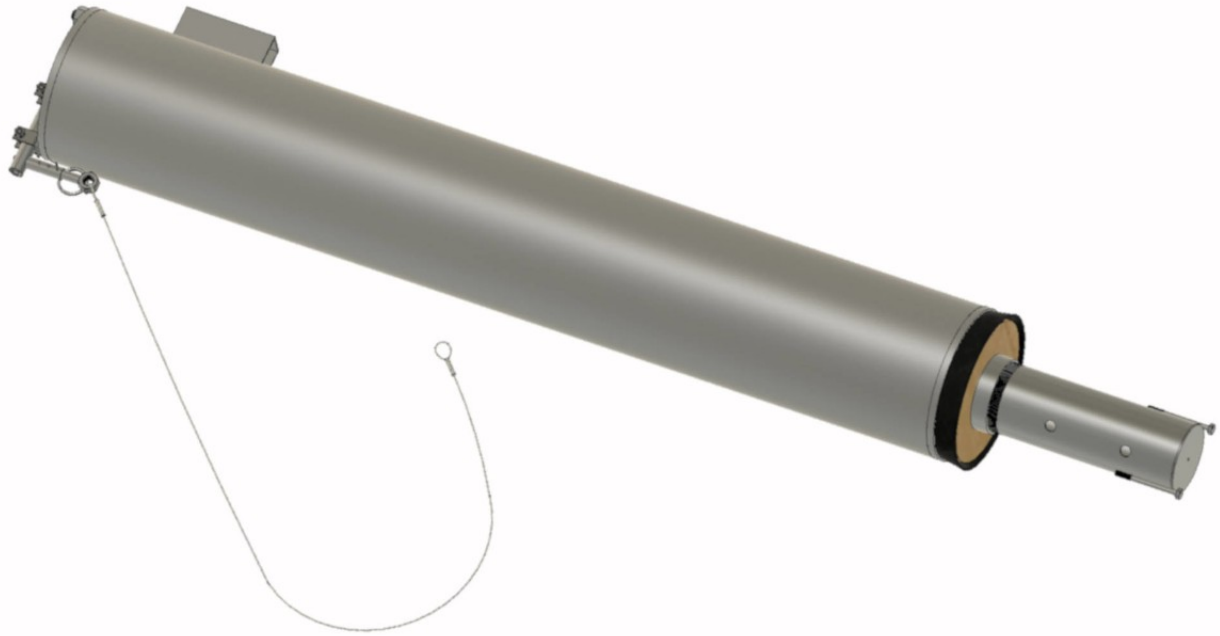
MK 10 mortar bomb with explosive components removed and disassembled bomb bodies.

PIRA Mark 10A Improvised Mortar Bomb

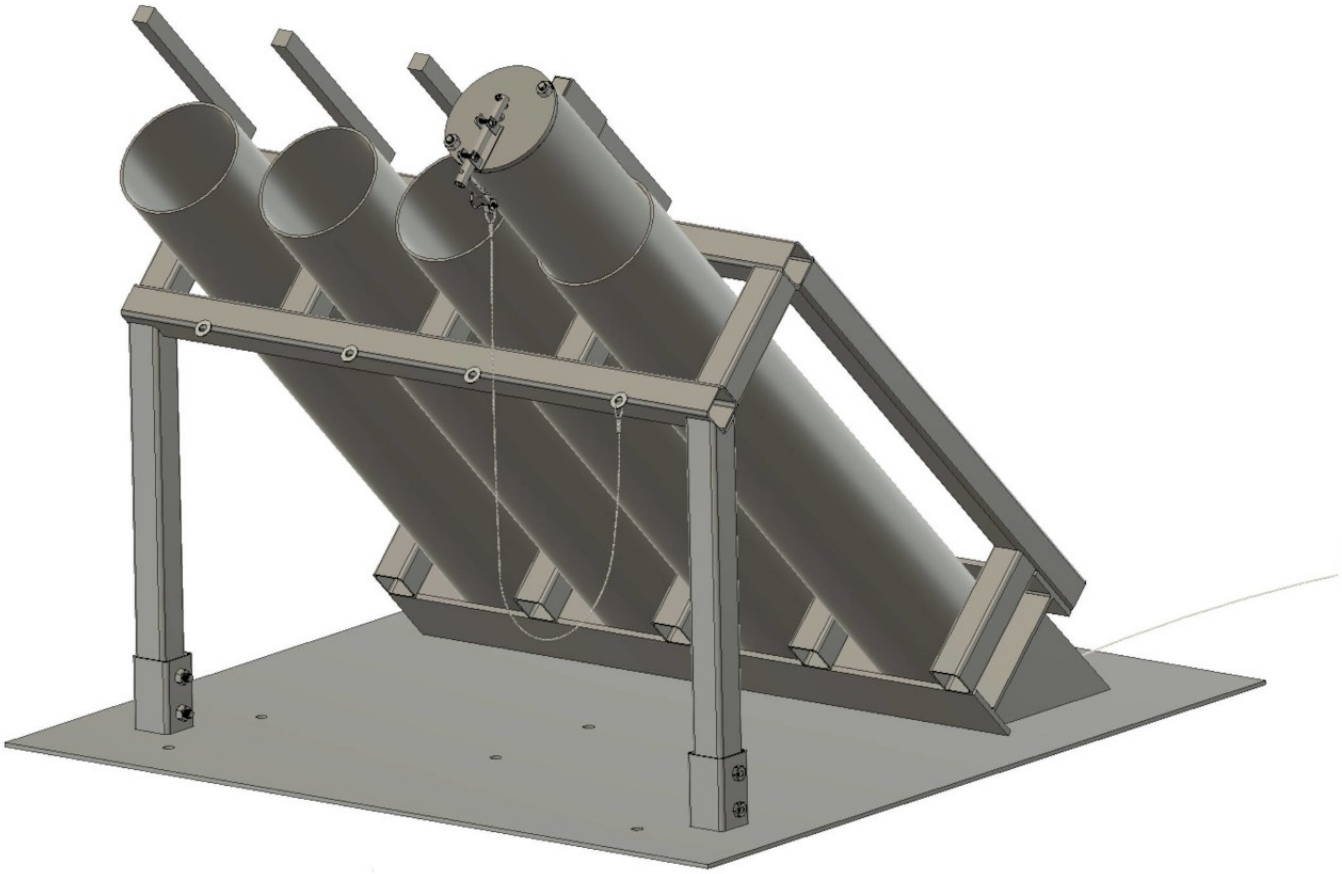
The Mark 10A mortar bomb includes a striker fired, time delayed fuze (MK 10/2) in an attempt to increase reliability. As the bomb leaves the launch tube, a detent (Attached to a length of steel wire secured to the launch frame) releases a spring loaded striker against a .22 rimfire cartridge which in turn ignites a length of safety fuse providing a short delay until landing and detonation. The MK 10A often includes a longer and larger diameter propelling spigot allowing for an increased propelling charge to be held internally.



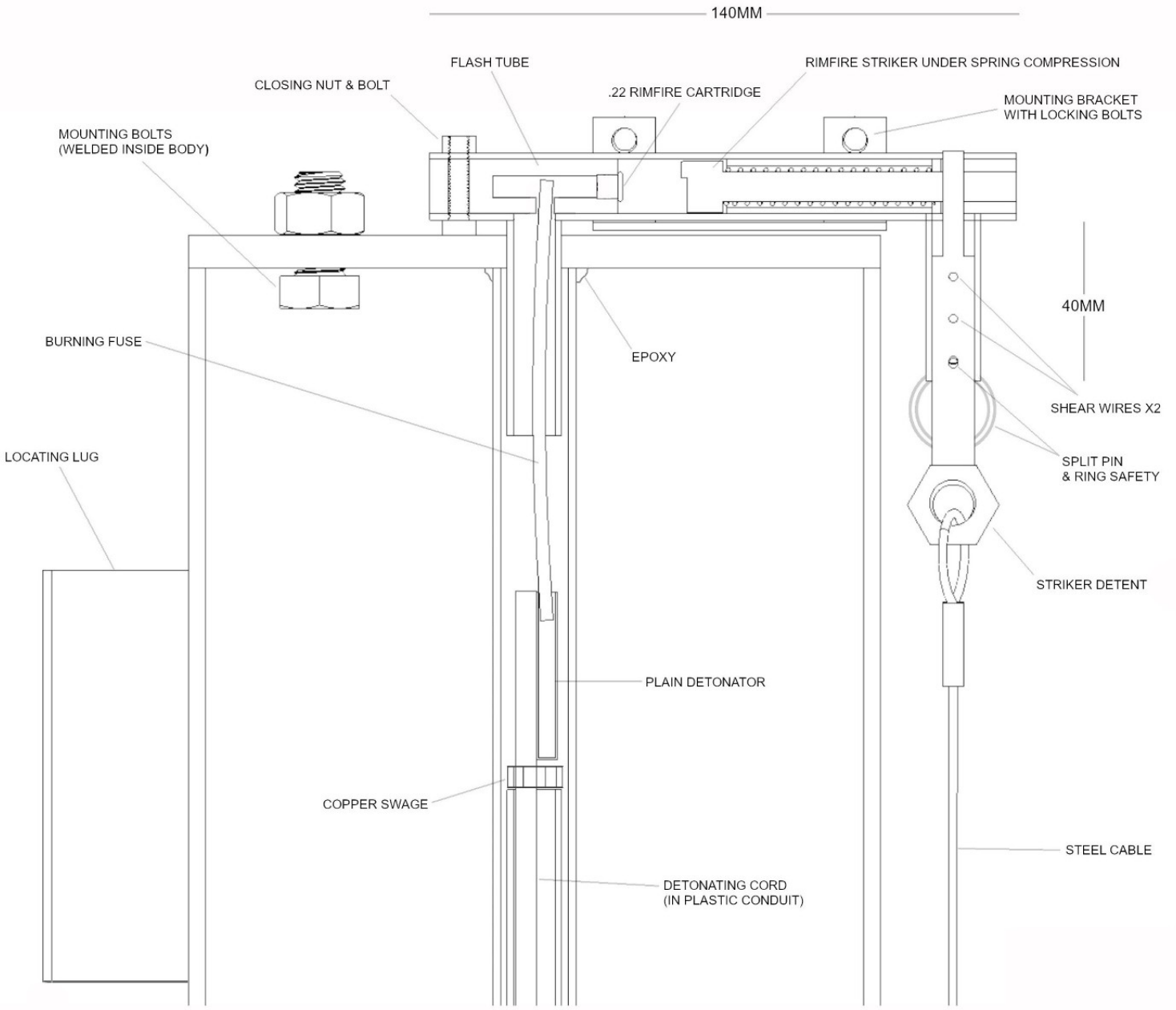
MK 10A MORTAR BOMB

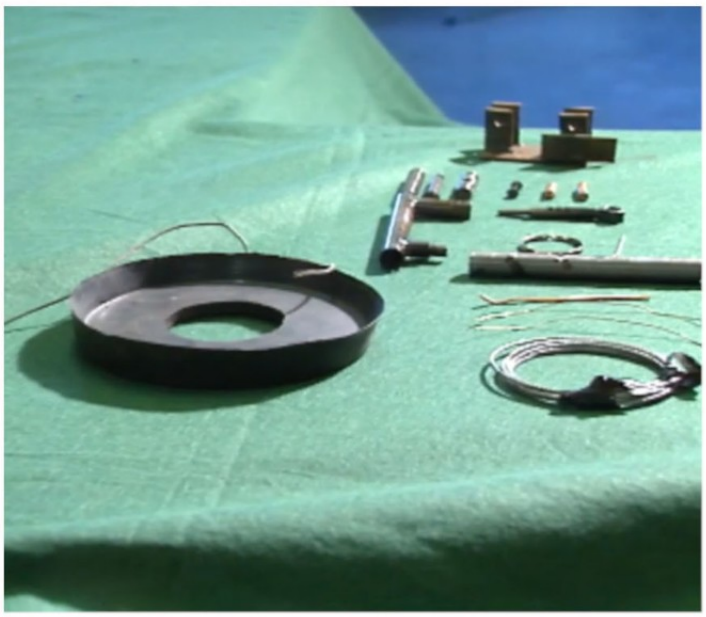


MK 10A LAUNCH TUBE AND BASE PLATE ASSEMBLY



PIRA MK 10/2 MORTAR BOMB FUZE



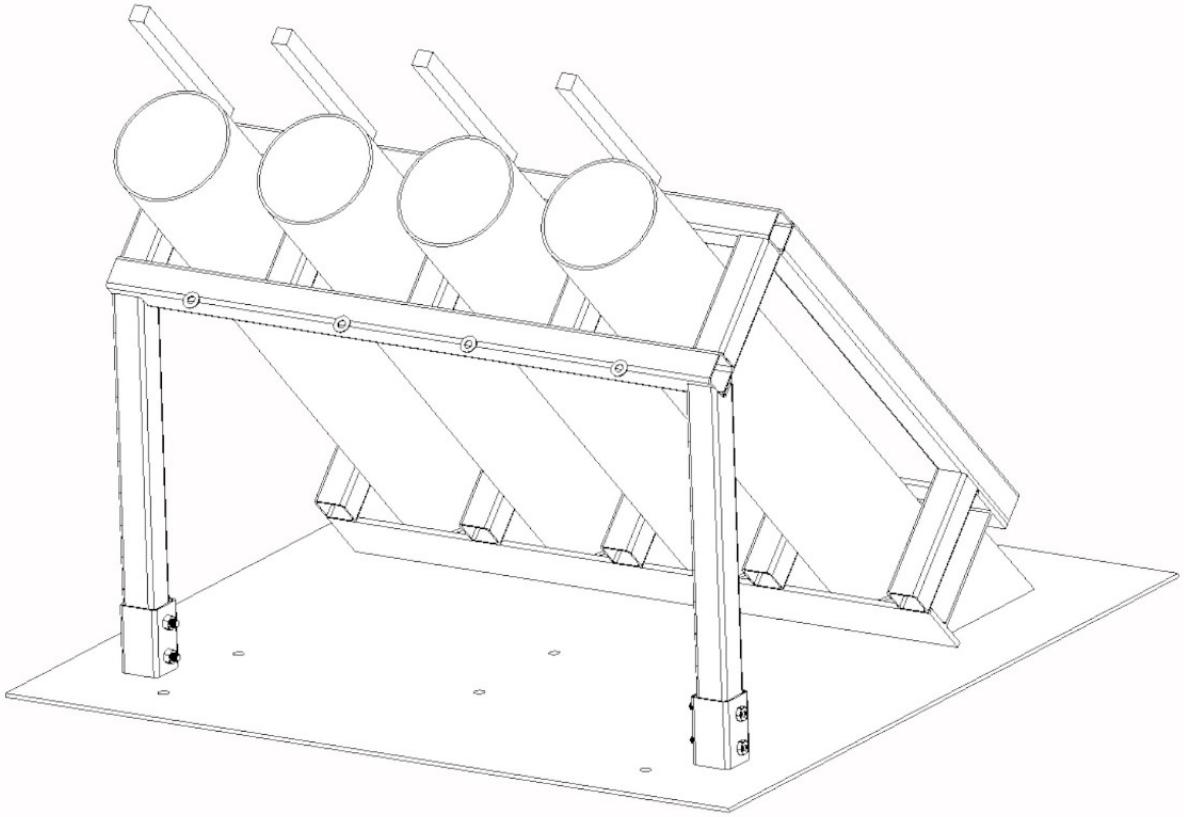


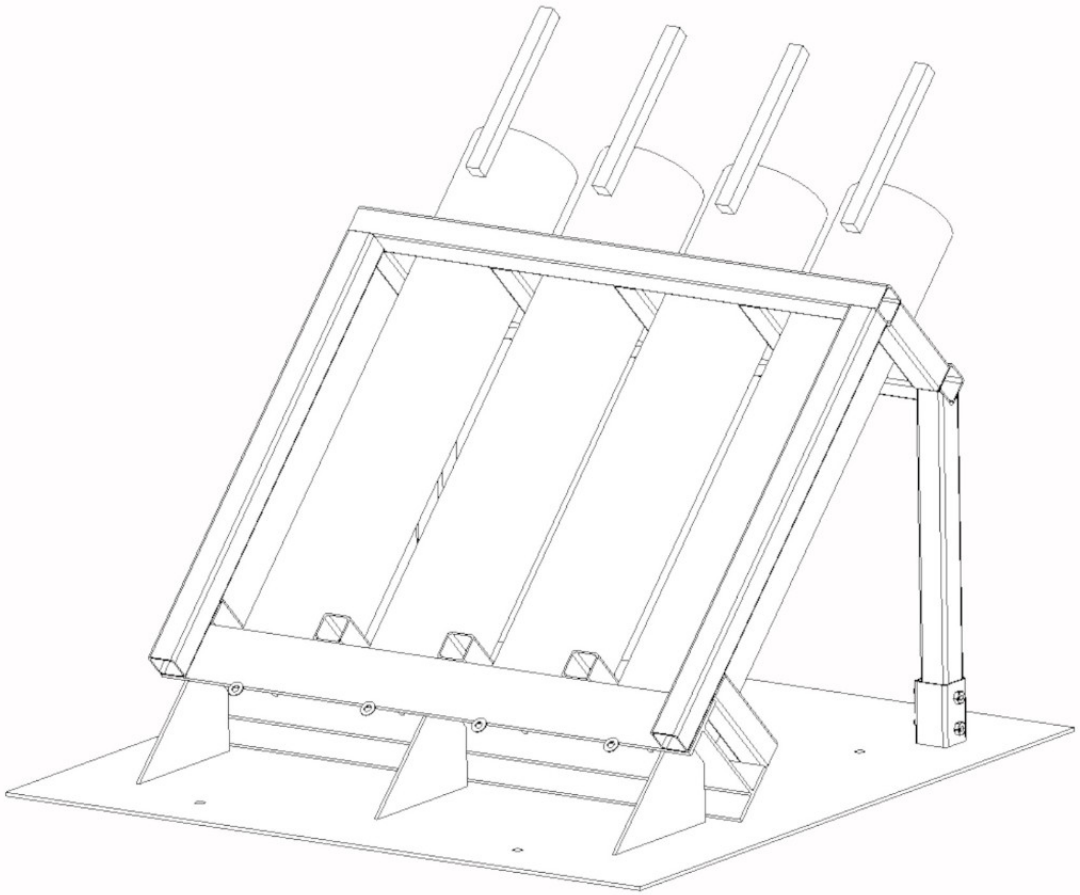
MK10/A mortar bomb and fuze components.

MK10/A mortar launch frame and bomb tubes.

MK10/A mortar launch tubes bolted to flatbed lorry.

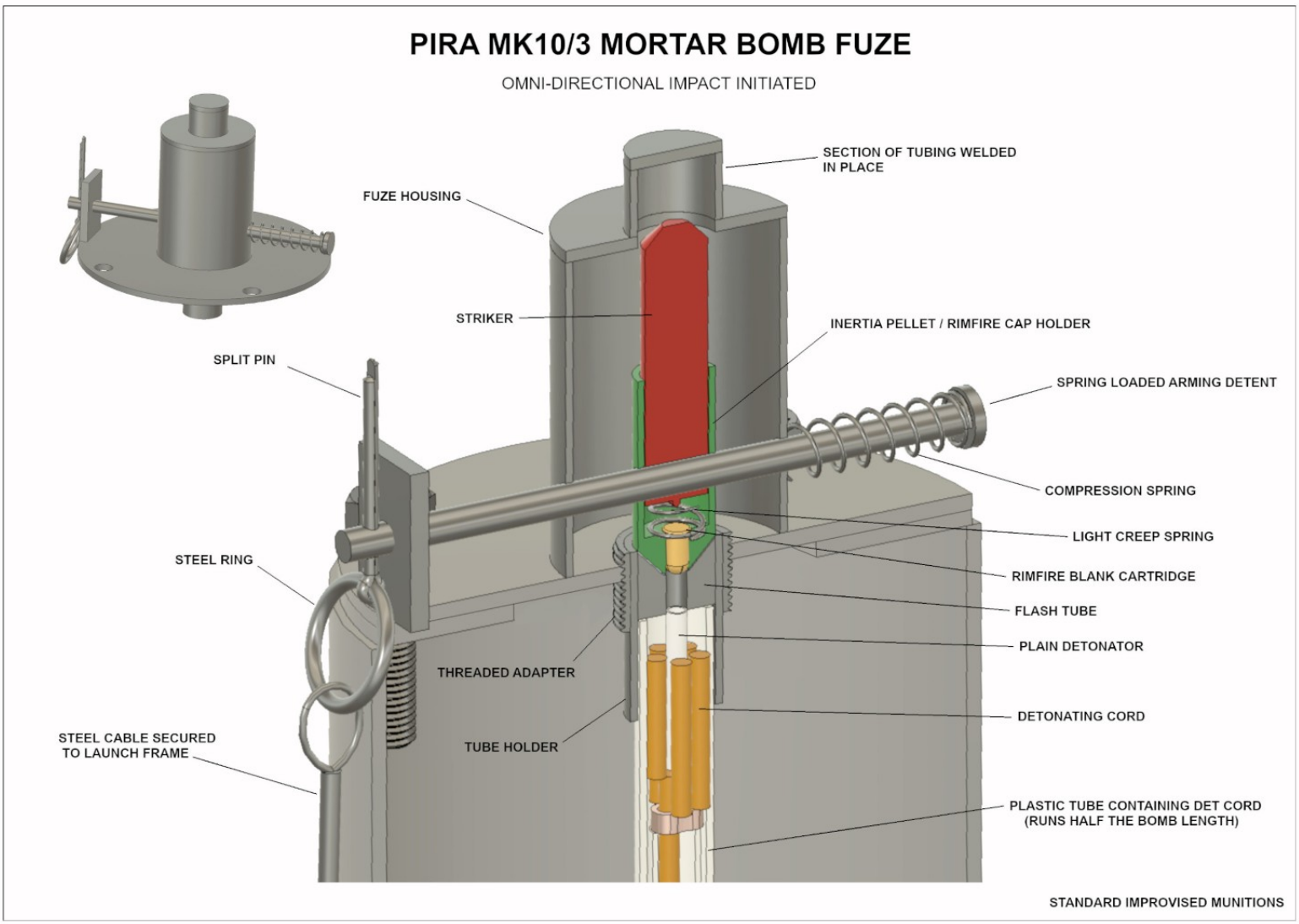
MK 10A LAUNCH TUBE ASSEMBLY





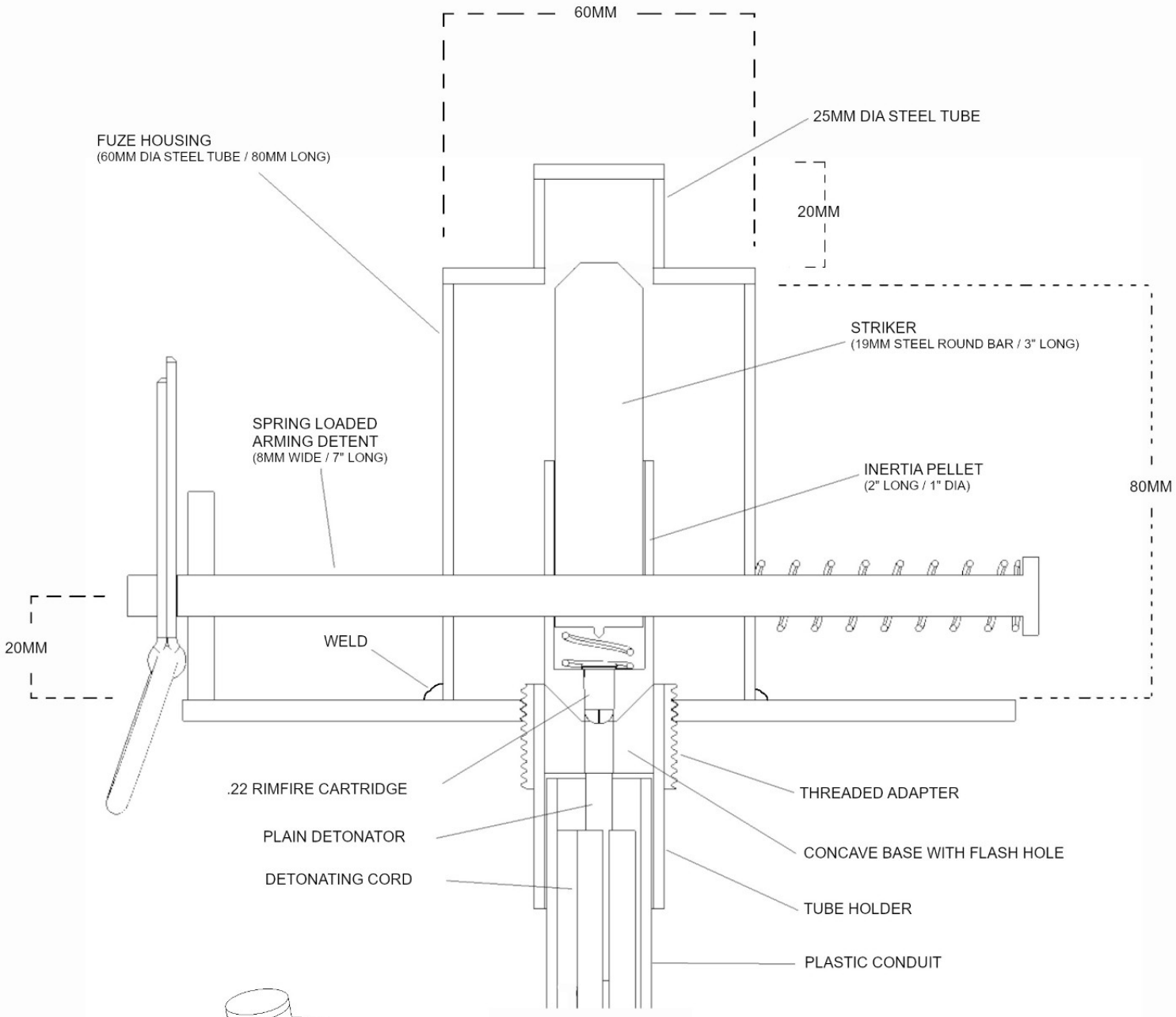
MK 10/3 Mortar Bomb Fuze

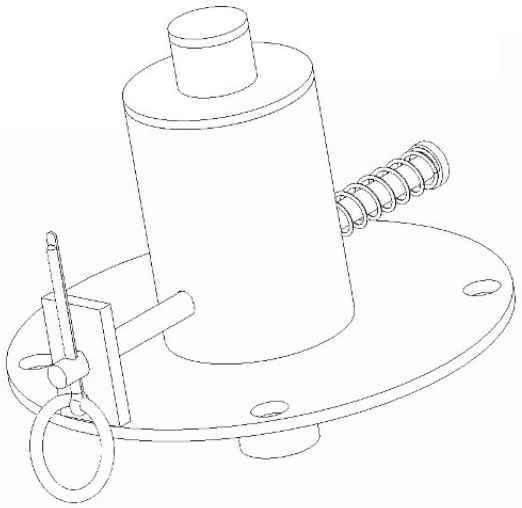
The MK 10/3 is a fairly sophisticated impact fuze which first appeared in use on the MK 10 but has since been used on multiple different improvised mortar bombs. It features an omni-directional striker and inertia pellet combination which can set off the bomb if it lands orientated in any direction. A housing made from welded together steel tubing contains a free-floating heavy striker and inertia pellet (containing a .22 rimfire blank) which is normally prevented from moving by a spring loaded detent bar running through the entire fuze assembly. When the mortar bomb exists the launch tube, a split pin attached to a steel cable (anchored to the launch frame) is pulled out of a hole in the detent bar allowing it to eject, leaving the internal inertia assembly free to move in all directions. A light creep spring keeps the striker away from the .22 blank until impact. A nose-first impact will cause the inertia pellet carrying the .22 blank to move forward against the striker. A tail-first impact will cause the striker bar to move down against the .22 blank. If the bomb lands at an angle or flat on its belly, the tapered ends of both the striker and inertia pellet will cause both to be forced inwards against the fuze houzing, crushing the creep spring and striking the blank cartridge which flashes through a hole in an adapter to a plain detonator.



PIRA MK 10/3 MORTAR BOMB FUZE

OMNI-DIRECTIONAL

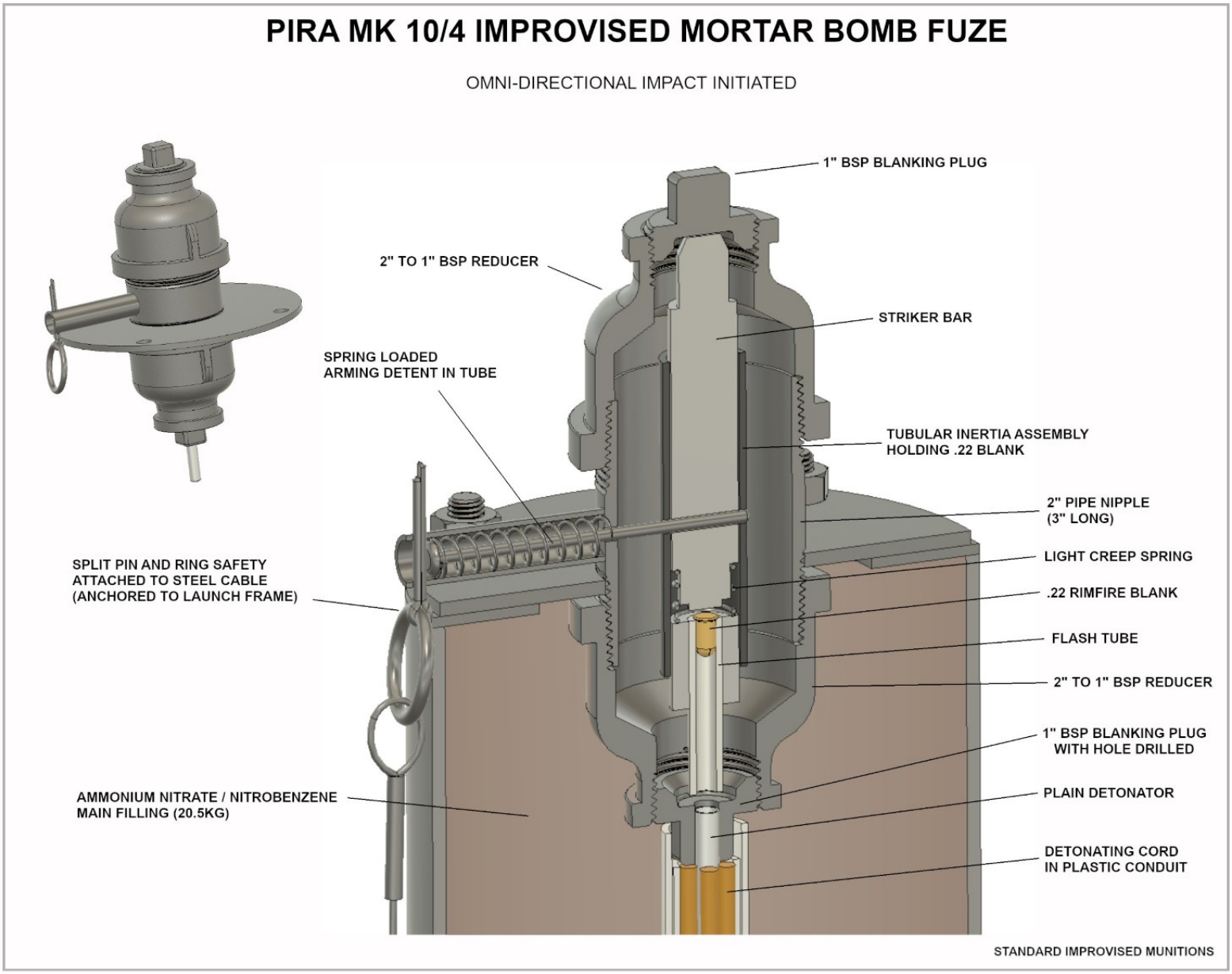




SECURED TO BOMB BODY VIA FOUR M10 BOLTS THROUGH PLATE

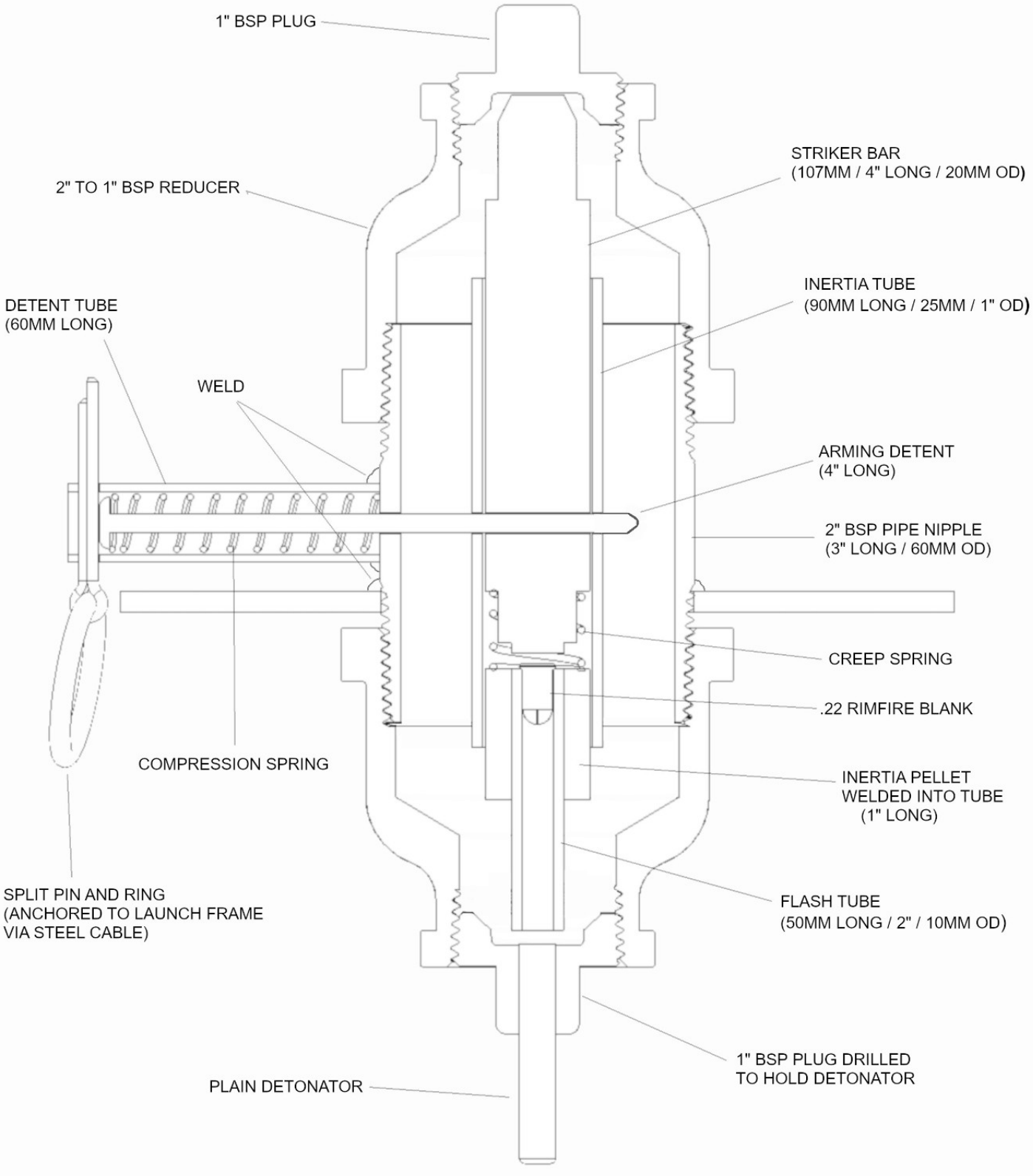
MK 10/4 Mortar Bomb Fuze

The MK 10/4 fuze is an improvised version of the MK 10/3 fuze and is instead assembled from standard pipe fittings. Like the later it contains a free-floating omni-directional striker and inertia pellet assembly which can set off the bomb no matter the orientation in which it impacts. In the case of an angled or belly-first landing, the bevelled interior of the fuze end plugs will cause the striker and inertia pellet assembly to be forced inwards, crushing the creep spring and striking the .22 rimfire blank which flashes through a tube to a plain detonator secured in the lower end plug.



PIRA MK 10/4 IMPROVISED MORTAR FUZE

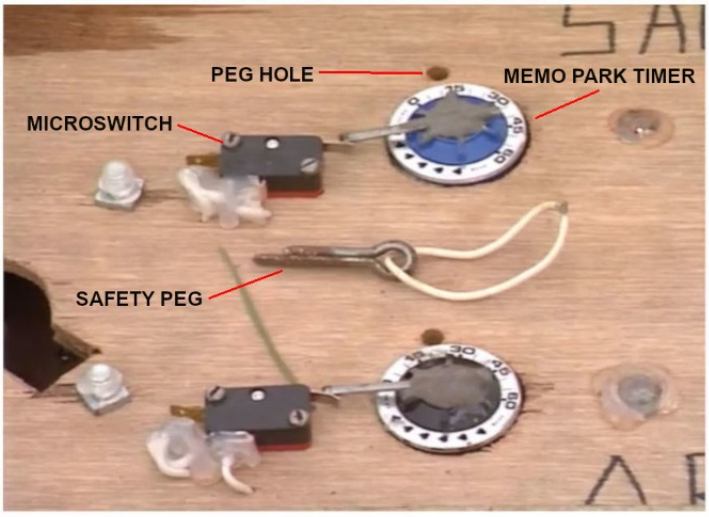
OMNI-DIRECTIONAL



SECURED TO BOMB BODY VIA FOUR M10 BOLTS THROUGH PLATE

Left: **MK10/3 fuze fitted to mortar bomb.** *Right:* **Six tube launch assembly concealed inside van with section of roof removed.**

Left: **Recovered mortar bombs.** *Right:* **View of propelling spigot.**



Timing and Power Unit (TPU) for mortars. To arm, each switch is flicked down and the safety pegs are removed allowing the mechanical parking or kitchen timers with rods glued in place to press a microswitch after a set amount of time. An incendiary device is also timed to go off shortly after the mortars are fired to destroy the vehicle and any forensic evidence remaining.

PIRA Mark-11 Improvised Mortar Bomb

The MK 11 mortar bomb is simply a shorter version of the MK 10 being half the size and capable of twice the range. It uses a modified MK 10/3 type impact fuze and is sometimes fired at a shallower angle aimed directly at a target. When fired from a full size launch tube the spring loaded arming detent of the fuze will rest against the launch tube interior and will automatically eject when the bomb leaves.

Overall length	880mm (approx)
Bomb body length	500mm
Bomb diameter	165mm (6.5")
Bomb body	Oxy-acetylene gas cylinder
Ignition	Electric
Fuze initiation	Impact
- Type	Omni-directional striker and inertia pellet
Main filling	10KG ammonium nitrate / nitrobenzene

Top: **Ten tube MK 10 vehicle attack in Newtownhamilton.** *Bottom*: **Single launch tube with TPU used in attack in Crossmaglen, 1983.**

EOD TASK 135679 28 FEB 1985

MORTAR ATTACK - NEWRY RUC STATION

FORENSIC RECOVERED FROM SCENE

1. BASE PLATE (GR [redacted])

a. Vehicle - Ford Custom Flatbed VRN [redacted]

b. Mortar base plate comprising :-

1. 9 mortar tubes (space for 10)
2. Associated mounting framework which was bolted to floor of vehicle.
3. Qty of wooden pallet bases used to disguise the payload.
4. Pieces of black plastic sheeting which actually covered the mortar tubes even during firing.

c. Firing box - Located inside cab of vehicle comprising :-

[redacted]

d. Also from the cab / [redacted] possibly used during hijacking.

e. Further technical details and measurements are not yet available due to the fact that NIFSL recovered the base plate complete after clearance operation.

2. IMPACT AREA (GR [redacted])

a. Qty of mortar bomb body fragments including forward closing plates, rear closing plates and tail spigots.

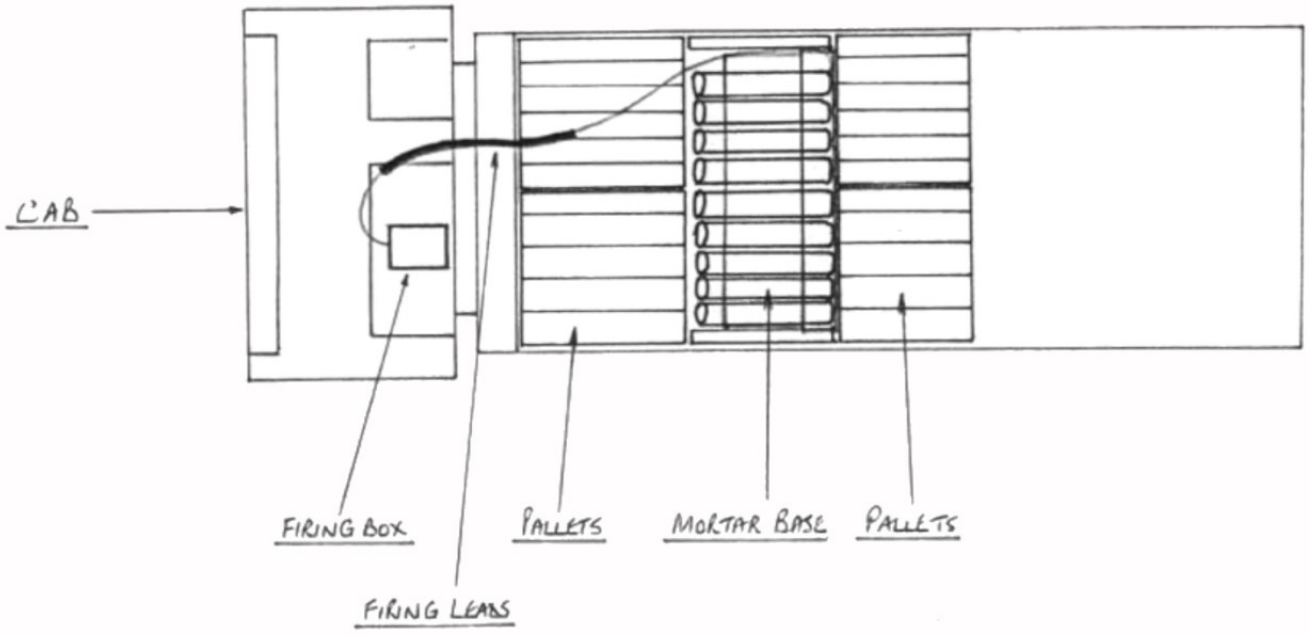
b. From mortar at GR [redacted] :-

1. MK 10 mortar body.
2. Front closing plate.
3. Tail spigot
4. Length of burning fuse
5. Length of detonating cord
6. Plain commercial detonator - [redacted]
7. [redacted]

c. From mortar at GR [redacted] :-

1. Mortar MK 10 body.
2. Front closing plate
3. Tail spigot
4. Length of detonating cord
5. [redacted]

EOD TASK 135679 MORTAR ATTACK NEWRY RUC STN 280285 BASEPLATE LAYOUT



FORD CUSTOM FLATBED VRN: [redacted]

MORTAR PROTECTION FOR SECURITY FORCE BASES

BACKGROUND

1. There are a total of 19 'border' Security Force (SF) bases in the Province, ten of which are police stations in which soldiers are stationed to provide protection. Each one of these bases is a potential target for a heavy mortar attack. To date (30 Jan 80) there have been 74 mortar attacks of all varieties against SF bases throughout the Province, since December 1972. The newest mortar, the Mark 10, was used against RUC Newtownhamilton on 19 Mar 79, resulting in the death of one soldier and the wounding of 5 soldiers and 2 RUC from shrapnel.

2. In October 1976 the decision was made to provide mortar protection at RUC Crossmaglen. This decision arose from the mortar attack on the Crossmaglen base on 31 August 1976 in which 6 members of the SF were injured.

3. The work started in November 1976. One troop of Royal Engineers has been continually involved in the build since then. Phases 1 and 2 of a 4 phase build are now complete. The current phase (3) is the rebuild of the RUC station on behalf of the Dept of Finance. The complete build is due to be completed in 1981.

4. As a result of a mortar attack on RUC Forkill on 23 January 1978 in which 10 members of the SF were injured, it was decided that mortar proof accommodation be built there also. To date Phase 1 of a 3 phase build has commenced. This build is also due to be completed in 1981.

AIM

5. The aim of this paper is to outline the mortar threat to SF bases and to describe the measures taken to counter this threat.

THE THREAT

6. The introduction of the Mark 10 mortar, firing a bomb weighing 100 lbs containing 40 lbs of explosive, poses an increased threat to all SF bases. The blast effect of the bomb is equivalent to 12 lbs TNT; the mortar protection of Forkill and Crossmaglen buildings required some strengthening to counter the increased kinetic energy of the weapon.

7. The Scientific Adviser to the GOC Northern Ireland (SCIAD) has estimated that the greatest weight of bomb likely to be used would be about 150 lbs all up weight and would contain up to 80 lbs of HME.* This would give a blast equivalent of 24 lbs TNT. SCIAD has agreed that it would be most unlikely for technical and supply reasons for PIRA to use commercial explosive for their mortars. As a result the maximum blast effect which needs to be considered

* Home Made Explosive

is 24 lbs TNT and the maximum weight of the bomb is 150 lbs. These two parameters constitute the "design threat".

8. PIRAs use of heavy mortars (Marks 8-10)have been confined to date to the border areas:

Base	No of attacks		
	Mk 8	Mk 9	Mk 10
Crossmaglen	1+1 NK	1	
Forkill		1	
Bessbrook	1		
Newtownhamilton			1

9. Use of the heavy mortar usually starts with a hijacking of a suitable flat bed lorry and supporting cars in the border area or in the Republic. The lorry is then fitted out with the mortar, and a prefabricated base plate and firing mechanism. Within about 3 hours of the hijacking the lorry is brought to within range of the selected target, an operation that requires up to 20 men in supporting roles. The lorry is parked at a previously selected base plate position, the mortar initiated electrically according to a timed programme and the PIRA team make their escape to the Republic. Because of the complexity of the operation and the number of men involved, it is unlikely that a heavy mortar would be used so far from the border that the escape of the supporting team would be prejudiced.

OPTIONS IN THE LIGHT OF THE THREAT

10. The PIRA mortar threat poses options, which are themselves not mutually exclusive. These are:

a. To deter an attack.

b. To save lives should an attack occur.

DETERRENCE

11. In considering deterrence, it is first necessary to list the basic factors that govern whether or not an attack is likely to take place. An attack is only likely to take place if:

a. There is a suitable firing point (that is a firing point at the desired range, with suitable aiming marks, and concealed from view from those within the base).

b. Terrorist escape routes are clear (that is a route exists offering a run, free of interference, to a safe point by the time the first bombs have been fired, or shortly after this time).

12. From these two points it is apparent that a reasonable prediction may be made of those bases vulnerable to attack, and the way in which they might be attacked. Deterrent measures may then be considered. Essentially, such measures will fall into one of two categories:

a. Protective surveillance of probable mortar firing points.

b. The tasking of external patrols and blocks to disrupt any contemplated attack.

13. The Surveillance Cell HQNI has carried out a survey to assess the mortar threat to all border bases. An example of such a survey carried out at Newtownhamilton is at Annex A.

14. These surveys are based on a system of logical analysis:

a. First. Areas of hard standing within mortar range of a base that could form mortar base plate positions are plotted.

b. Second. Those areas within the arc of fire of occupied sangars are disregarded.

c. Third. Those positions remaining are examined to see which are within sight of some aiming mark in the base (such as a radio mast) or a similar prominent mark on line to the base.

15. From this analysis can be worked out the remaining most likely firing positions. A combination of patrols, surveillance devices and barriers can then be deployed to cover these areas or deny access to them.

16. Therefore if deterrent measures are considered carefully, the mortar threat can be reduced to a low probability. Some element of risk will always remain, but that risk will be reduced as much as possible.

PROTECTION

17. No deterrent system can offer a guarantee of immunity from attack. It is therefore necessary to consider how lives may be saved, or injuries reduced, in the event of an attack. In considering this, the options are:

a. Full mortar protection (vide Crossmaglen and Forkill).

b. Limited protection.

c. Tactical considerations.

18. Full Protection. Full protection is expensive in terms of engineer resources and in terms of real costs; and such a construction programme takes a long time to complete. This solution has now been rejected for any base other than Crossmaglen and Forkill; to which regular resupply convoys carrying engineer stores are deployed. These operations last up to 5 days and involve major Brigade picket and route clearance operations.

a. Crossmaglen.

(1) The Phase 1 building has a weldmesh stand-off screen to catch and detonate bombs. This screen required strengthening to cope with the increased kinetic energy of the design threat described. MVEE designed and trialled a suitable screen consisting of an 8mm mild steel plate supported on 1.7m high scaffolding towers and covered with a layer of sandbags. The material for the screen was readily available and cost about £10,000. This cost was met by Engineer funds already allocated. No additional resources from outside the Province were needed to complete the project. The erection of the screen is now complete.

(2) PSA (DCES) who designed the Phase 2 building advised that the roof of the building would also require strengthening to cope with the design threat. Consequently the MVEE[a] designed screen was extended over both the Phase 1 and 2 structures.

b. Forkill.

(1) The walls of the Forkill building were designed to provide protection against a Mark 9 mortar bomb exploding one metre away from them. Such a mid-air explosion is considered by RARDE[b] to be most unlikely. Without redesign these walls afford complete protection against the design threat[c] exploding 2m away. In view of the unlikelihood of such a detonation it is considered that this level of protection is adequate.

(2) Minor strengthening of the sacrificial storey cladding[d] and the base blast wall was necessary to meet the design threat. There will be no significant increase in the cost of the project and no increase in the time scale.

c. Risk. During the building of the bases above, a greater number of soldiers are concentrated and therefore at greater risk in the short term. As the build continues the target area increases.

19. Limited Protection. Limited Protection covers a wide range of measures from construction short of full protection to, at the simplest level, the provision of blast wall and open shelters. It is clear at once that no common design could be envisaged as standard protection for any base. It is also clear that a survey of any base would lead to the suggestion of a number of simple, effective protective measures which could reduce casualties in the event of a mortar attack. A study on limited protection was carried out by Commander Royal Engineers. Work is now complete in providing blast walls and shelter trenches at all bases assessed to be under threat in that study.

Notes: a. MOD Military vehicles and Engineering Establishment, Chertsey
b. Royal Armament R & D Establishment, Fort Halstead
c. This is the threat described in para 7 above.
d. See plan at Annex B

20. Tactical Considerations. The mortar threat to border bases, particularly in South Armagh, is treated extremely seriously. In order to reduce this threat a 24 hour patrol coverage of the immediate area is a standing operational procedure. In Forkill, for example, this deterrence presence requires a dedicatedplatoon, and in Crossmaglen two platoons are required. This manpower, committed purely to the defence of the base, is a permanent requirement. There is consequently the danger of dissipating one's effort on purely defensive tasks. Too little local patrolling and the bases are in danger of mortar attack. Too much patrolling and the patrols themselves, and not the bases, become the target for snipers and bombs. There is therefore a fine balance to be drawn on the level of local patrolling carried out. This balance is the decision of the local commander, based on the threat and intelligence available at the time.

SAFETY DRILLS

21. Drills required to take cover from a mortar attack are well known to all soldiers; they are taught during pre-Northern Ireland training and rehearsed in all the border bases. An attack warning system exists in every border base. In combination with the simple limited physical protection of blast walls and the like, such drills will save lives.

CONCLUSIONS

22. The threat of mortar attack is markedly reduced by selective patrolling and the use of surveillance devices. The costs are minimal compared to the costs of full mortar proofed accommodation (something in the order of £12,000 per base against £900,000 per base).

23. Should an attack occur, casualties are limited by:

a. Simple, low cost protection against blast, as has been used effectively in the past (as a matter of normal soldiering) against such a threat.

b. Local patrolling to deter the terrorist or make it necessary for him to engage the target from an unsatisfactory position.

c. Adopting well thought out and well rehearsed anti-mortar drills in the event of an attack.

ANNEX
A. Surveillance Survey - Newtownhamilton

CONFIDENTIAL

ANNEX A

1039/4/1

SURVEILLANCE SURVEY
NEWTOWNHAMILTON

INTRODUCTION

1. The Newtownhamilton SF base was mortared from a lorry parked as shown on 19 Mar 79. (Annex A).

2. Two areas, The Common and Newry Road, are considered to be the most likely mortar firing points as:

a. They cannot be seen from existing sangars.

b. They can see aiming marks within the base.

c. The lines of fire do not pass over occupied buildings.

3. The firing points in Rathole Lane and the northern end of Armagh Street are considered possible but unlikely for the lines of fire pass over occupied buildings.

REQUIREMENT

4. The surveillance requirement is to provide observation over The Common and Newry Road.

PROPOSED CORNER SANGAR

5. OC D Company 3 QUEENS has requested that a sangar be built within the base at the corner at the junction of Shamble Lane and Newry Street:

a. To improve the view of possible mortar FPs east of the Fire Station.

b. To improve the close protection of the permanent VCP outside the SF base.

6. Comment

a. There is already a sangar at ground level on the southwest side of the junction of Shamble Lane and Newry Street. Its field of view and fire along both is adequate for the close protection of the VCP. It is understood however that the sentry is also required to spot for Vengeful as so becomes distracted from his primary protective task during periods of heavy traffic.

b. The cover from view screen at the corner is approximately 10 m high. From its top Newry Road between the shop and the Masonic Hall cannot be seen. The view onto the corner from a sangar at that height would be very restricted and a sentry in it would not be able to assist in the close protection of the VCP. He would be able to see the Newry Road beyond the Masonic Hall, but the range of 200 m would prevent him using his weapon effectively at targets there.

CCTV

7. From the top of the cover from view screen (10 m above ground level) at position A it is possible to see most of The Common (as shown) and the roofs of cars moving down Newry Road between the Shops and the Masonic Hall.

8. A steerable camera on this site, but elevated to 20 m above ground level would be able to see at street level in this area. Complete coverage of The Common would still not be possible but the coverage would be better than now.

9. To obtain complete coverage of the Common a second camera would be required in position B. It is understood that this has already been investigated but that there are legal and CR difficulties over the proposed site.

10. The CCTV already covering the helipad cannot see any of these areas nor can it be modified to do so. It is already monitored in the Ops Room, but if a second TV is to be placed there, the Helipad monitor should be in the Guard Room.

SUMMARY

11. Observation is required of The Common and Newry Road beyond the Fire Station.

12. The proposed corner sangar would not be able to observe Newry Road.

13. A CCTV camera at A would cover all Newry Road and most of the Common.

14. A CCTV camera at B would cover the whole of the Common but there are problems in acquiring its site.

15. The security of the VCP could be improved by double manning the sangar at the junction of Shamble Lane and Newry Street at busy periods; one man to spot for Vengeful, one man to act as cover sentry.

RECOMMENDATION

16. A CCTV camera (specification at Annex B) should be erected at A to observe Newry Road and most of the Common.

17. As a second priority, and after the installation and evaluation of the camera at A, the installation of a camera at B to cover the whole of the Common should be considered.

18. The control position for the Helipad CCTV should be moved to the Guard Room.

IMPLEMENTATION

19. This CCTV system will be included in the consolidated requirement under preparation within this HQ.

N H H ADAMS
Major
GSO 2 Surveillance

30 Apr 79

CONFIDENTIAL

ANNEX A TO 1039/4/1
DATED 30 APRIL 1979

NEWTOWNHAMILTON SF BASE APPROACHES

LEGEND

Possible mortar FPs, not visible to existing sangars

Effective Mortar Range

SF Base Perimeter

Existing Sangars □

Camera Position B

Left Limit of Visibility over The Common from A

Camera Position A

Proposed Corner Sangar ■

Mortar FP used 19 Mar 79 ○

Area not visible from proposed Corner Sangar